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REPORT OF

Thirty-Third Annual

DATE GROWERS' INSTITUTE

April 28, 1956



HELD IN

COACHELLA VALLEY

CALIFORNIA

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THIRTY-THIRD ANNUAL DATE GROWERS' INSTITUTE

HELD IN
COACHELLA VALLEY

APRIL 28, 1956

VOLUME 33

CHAIRMAN MORNING SESSION
Dr. Walter Reuther
Citrus Experiment Station
Riverside

CHAIRMAN AFTERNOON SESSION
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Coachella

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PROGRESS REPORT ON CONTROL OF DATE INSECTS

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In 1953 Lindgren and Vincent (1) reported the experimental use of malathion (O, O-dimethyl thiophosphate of diethyl mercaptosuccinate) — an organic phosphate insecticide of low mammalian toxicity—for the control of nitidulid beetles² and pyralid moths³ infesting dates in the bunch. In 1954 Vincent and Lindgren (2) reported on the results obtained with this insecticide when applied under commercial conditions at the rate of 40 pounds per acre approximately 3 weeks prior to the first picking. The results of these experiments indicated that malathion might be of commercial importance, and consequently on the basis of information developed on insect control and residue present this material was accepted for use on dates by both the State and Federal Departments of Agriculture. The Miller amendment to the Pure Food Law—the Federal Food, Drug, and Cosmetic Act of 1938—which went into effect on July 22, 1955, allows 8 parts per million malathion residue on dates for interstate shipment. Results of work by Lindgren and Vincent (1) indicate that the malathion residue present on dates 3 to 4 weeks after treatment ranges from 1 to 1.25 parts per million on unwashed fruit, and is less than 1 part per million on washed fruit.

Another organic phosphate compound having a mammalian toxicity rating similar to that of malathion was recently made available for experimental use. This compound is chlorthion (O, O-dimethyl O-4-nitro-3-chlorophenyl thionophosphate). Results of comparative studies of mala-

¹The writers wish to express their appreciation to various date growers, packing-house operators, and to the staff of the U. S. Date Garden at Indio for their cooperation.

²*Carpophilus dimidiatus* (Fab.), *C. hemipterus* (L.), *Urophorus humeralis* (Fab.), and *Haptoncus luteolus* (Er.).

³*Ephestia figulilella* Greg. and *Plodia interpunctella* (Hbn.).



Fig. 1. Adults of four species of nitidulid beetles found infesting dates. Left to right: *Urophorus humeralis* (F.), *Carpophilus hemipterus* (L.), *Carpophilus dimidiatus* (F.), and *Haptoncus luteolus* (Er.).

thion and chlorthion are presented in this paper.

Field tests were conducted in 1954 and 1955 on two varieties of dates that are usually subject to insect infestation. The Khadrawi variety was chosen as a representative of the soft or invert-sugar group, and the Deglet Noor variety as a representative of the cane-sugar group. A single Khadrawi plot was located at Indio. Two

Deglet Noor plots were used, one located at Indio and the other at Thermal. Two separate dust treatments were applied at each of the above plots, one being a 4 per cent malathion dust and the other a 5 per cent chlorthion dust. Applications were at the rate of 40 pounds per acre approximately 3 weeks prior to the first picking. Treatments were applied by a rotary hand duster and

Table 1.—Effect of malathion* and chlorthion* dust treatments on infestation of Deglet Noor and Khadrawi dates by Nitidulid beetles and Pyralid Moths, 1954 and 1955.

Plot & Treatment	Infested with Beetles	Infested with Moths	Spoiled by Fungus	Beetles Present on Final Examination	
				Dead	Alive
1954					
Deglet Noor Plot					
None (control)	65.6	2.4	83.8	12347	0
4% malathion	23.2	0.8	85.1	66	6411
5% chlorthion	24.1	0.7	82.1	117	8605
Khadrawi Plot					
None (control)	6.2	0.8	0.8	184	0
4% malathion	2.3	0	0.6	2	56
5% chlorthion	1.8	0	0.4	0	81
1955					
Deglet Noor Plot					
None (control)	41.5	7.5	66.6	18063	0
4% malathion	20.2	1.2	55.7	329	3574
5% chlorthion	16.8	1.6	61.2	14	3453
Khadrawi Plot					
None (control)	2.9	2.5	0.3	183	0
4% malathion	2.2	0.1	0.4	1	119
5% chlorthion	1.0	0.1	0.3	8	67

* A 4 per cent malathion dust formulation and a 5 per cent chlorthion dust formulation were applied separately to date bunches at the rate of 40 pounds per acre approximately 3 weeks prior to the first picking.

all date bunches were thoroughly dusted. The Deglet Noor bunches in both plots were covered with paper bags prior to dusting. Dates were picked at weekly intervals and for the most part consisted of culls which normally would have been shaken out of the bunch prior to a commercial picking. The dates were then checked for insect infestation and fungus spoilage. Results of these treatments are given in table 1.

In the Deglet Noor plots, fruit from the untreated (control) bunches averaged 65.6 and 41.5 per cent infestation by nitidulid beetles in 1954 and 1955 respectively, while fruit from the malathion-treated bunches averaged 23.2 and 20.2 per cent and that from the chlorthion-treated bunches averaged 24.1 and 16.8 per cent. Moth infestation in these plots was reduced from 2.4 and 7.5 per cent in the untreated bunches to 0.8 and 1.2 per cent in the malathion-treated bunches, and to 0.7 and 1.6 per cent in the chlorthion-treated bunches for 1954 and 1955 respectively. The numbers of live beetles present in the untreated (control) bunches were 12,347 and 18,063 respectively for 1954 and 1955, while the numbers found in the malathion-treated bunches were 66 and 329, and in the chlorthion-treated bunches 117 and 14 respectively.

In the Khadrawi plot the fruit from

the untreated bunches averaged 6.2 and 2.9 per cent infestation by nitidulid beetles for 1954 and 1955 respectively, while that from the malathion-treated bunches averaged 2.3 and 2.2 per cent, and that from the chlorthion-treated bunches averaged 1.8 and 1.0 respectively. Moth infestation in this plot was reduced from 0.8 and 2.5 per cent in the untreated bunches in 1954 and 1955 respectively to practically zero in those bunches receiving an insecticidal treatment. The numbers of live beetles present in the untreated (control) bunches were 184 and 183 for 1954 and 1955 respectively, while the numbers found in the malathion-treated bunches were 2 and 1, and in the chlorthion-treated bunches 0 and 8.

Fungus spoilage was approximately the same in both the untreated and treated bunches in each of the three experimental plots. It would appear from the above data that chlorthion is equally as effective as malathion in controlling the nitidulid beetles and pyralid moths infesting dates.

Chlorthion, at the present time, cannot be used commercially on dates until residue data has been obtained and a tolerance has been established for it under the Miller amendment.

Five new materials and sulfur were tested against the date mite, *Oligonychus pratensis* (Banks) [= *Paratetranychus simplex* (Banks)]. The effective-

ness of these materials when applied as dusts is given in table 2. R1303 and FW293 appeared to give control comparable to that obtained with sulfur and they will be further tested during the forthcoming season.

The most effective control of date mite is obtained when the dust is thoroughly applied to each bunch prior to the production of extensive webbing by the mite. Sulfur is not considered a hazardous residue and therefore no tolerance has been established under the Miller amendment.

Table 2.—Effectiveness of various acaricides applied as dusts to date bunches for date-mite control, 1955.

Acaricide	Per Cent Infestation	
	Pre-treatment Check	4 week Post-treatment Check
None (control)	18.2	100
25% R1303	81.3	6.3
Sulfur	80.0	15.0
4% FW293	66.7	20.9
20% Mitox	63.5	52.4
2% AC528	73.6	80.6
4% Chlorobenzilate	52.3	84.0

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THE SEASONAL USE OF WATER BY KHADRAWY DATE PALMS

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In an irrigation investigation with 18-year-old Khadrawy date palms a record of the use of water by the trees from the upper 7 feet of soil has been obtained during a period of 3 years (1953-1955). The results of the first 2 years of the irrigation experiment have been reported (3). This work was performed on an Indio very fine sandy loam near Indio, California.

Records of the consumptive use of water by dates, that is, of the water extracted from the soil by the roots of the trees and that lost by evaporation from the soil surface, are of obvious use in planning an irrigation program or in estimating the water requirements of date palms. Because the usual process of obtaining such records is laborious and time-consuming, they are not plentiful. In the stratified soils of the Coachella Valley downward percolation of water is, in many situations, so slow that under usual irrigation practice some difficulty has been experienced in obtaining reliable data on extraction of water by such deep-rooted plants as the date palm (6). In the present study difficulties resulting from slow drainage were largely overcome by allowing long intervals between irrigations.

The estimates of water extracted from the soil by the tree roots and that lost by evaporation from the soil surface were based upon soil-moisture determinations made several times between applications of water on plots irrigated at intervals of 8 weeks to 4 or 5 months. The samples were taken at foot intervals to a depth of 7 feet at 3 stations on each of 8 plots, each about 1/6 acre in area. The average soil-moisture percentages found at depth intervals of one foot on the plots of each irrigation treatment were plotted against time. The soil-moisture-extraction curves thus obtained were examined for indications of water loss by deep percolation soon after irrigation or of restricted extraction rates as the soil dried out.

It was found that soil samples taken sooner than about 8 or 10 days after an application of water could not be used reliably because of appreciable drainage in the top 7 feet during that period, and that samples taken after the soil had dried out to near the wilting point could not be used because the rates of extraction were abnormally low at such low moisture percentages. Thus, estimates of water use were based upon the soil-moisture losses observed during the per-

iods when nearly straight-line extraction rates were obtained. Soil-moisture percentages were converted to inches of water by the following formula:

$$D = \frac{Pvd}{100}, \text{ where } D = \text{inches of water,}$$

P=percent moisture on dry-weight basis,

v=volume weight of the soil,

d=depth in inches of soil sampled.

Determinations of volume weight of soil were made with a standard King soil tube by driving the tube in carefully to the foot marks and removing the tube with a soil-tube jack to avoid loss of part of the sample. Three samplings for this purpose were made at widely separated intervals and under soil-moisture conditions that were favorable for obtaining full cores. A comparison of the values obtained in the top foot of soil with the King tube and with a thin-walled steel tube 2.5 inches in diameter showed that the average value obtained with the King tube was 96 percent of that obtained with the large tube. It was therefore assumed that the values obtained for volume weight with the King tube were satisfactory for calculating the volume of water in the soil.

various soil depths were calculated.

All soil-sampling holes were filled and staked, and weeds were controlled by spraying with oil. The samples from the top foot of soil included the surface 4 inches, which is usually discarded in cultivated fields; and thus the use of water reported in this paper includes evaporation from the soil surface. Since, however, soil samples taken sooner than 8 days after an application of water were not included in the estimates of water loss, evaporation losses were probably very small as compared with transpiration losses by the trees. Loss from transpiration of weeds was insignificant since the plots were practically bare except for the palm trees.

Information concerning the distribution of date roots in the plots sampled for soil-moisture determinations was obtained by taking root samples to a depth of 20 feet (3).

RESULTS AND DISCUSSION

The percentage by weight of feeder roots¹ found at various depths in the upper 20 feet of soil at distances of 5 feet and 15 feet from the tree trunks and the amounts of water used from the upper 7 feet of soil are listed in Table 1. About 85 to 88 percent of the feeder roots found in the upper

Table 1.—Distribution of feeder roots¹ in the upper 20 feet of soil and the average yearly use of water from the upper 7 feet of soil.

Soil		Roots at indicated distance from trunk		Average yearly use of water
Depth (Feet)	Available water capacity (Inches)	5 feet (Percent)	15 feet (Percent)	(Depth-inches)
0-1	2.4	11.7	11.2	6.6
1-2	3.3	10.5	16.6	8.8
2-3	3.4	12.4	11.6	9.5
3-4	3.7	20.4	14.3	7.9
4-5	3.3	15.4	16.2	7.9
5-6	2.5	11.7	10.2	6.5
6-7	1.3	5.6	5.0	3.9
0-7		87.7	85.1	51.1
7-10		4.3	5.0	
10-15		4.3	6.2	
15-20		3.7	3.7	

1. Roots 1 millimeter or less in diameter.

The rates of water loss from each foot depth and the total loss from the 7-foot profile sampled were calculated for each period between samplings or for each period of nearly straight-line extraction rate. These rates were plotted on cross-section paper as straight lines for the time periods involved. From these data monthly and yearly rates of water use from the

20 feet of soil occurred in the top 7 feet, and from this zone the average yearly use of water was 51.1 inches.

The use of water was greatest from the 2 to 5-foot zone, which had the highest available water capacity and highest root concentration, somewhat lower from the 0 to 1- and 5 to 6-foot

¹Roots 1 millimeter or less in diameter.

depths, which were intermediate in available water capacity and root concentration, and lowest from the 6 to 7-foot depth, which was also lowest in available water capacity and root concentration.

In these strikingly stratified soils, roots of both dates and citrus usually develop somewhat in proportion to the available water-holding capacity of the soil composing the various strata in the principal root zone.

The average rate of evaporation of water from a shallow black-pan evaporimeter (7) and the average rates of water use from the 0 to 7-foot zone and from each foot depth of soil in relation to season are represented in Figure 1. The close similarity in shape of the evaporation curve and the curve representing use of water from the 0 to 7-foot zone shows that water use by the trees was probably determined largely by the same factors that determined the rate of evaporation from the evaporimeter.

Water use by the trees, including evaporation from the soil, was lower than evaporation from the evaporimeter from February to July and higher from October to January. There are probably several factors involved in this change in the relative rates of evaporation and of water use by the trees. During much of the time in spring, there are strong winds that would tend to increase evaporation more than transpiration (5). In summer and fall soil temperatures are higher than in late winter and spring (1) and, since leaf-growth rate reaches the yearly maximum in August or September (3), the surface of active young leaves is probably greater in summer and fall than in spring. Both of these factors would favor an increase in transpiration in relation to evaporation in summer and fall.

The curves representing loss of water from individual foot levels indicate that the losses from each level

except the top foot maintained nearly the same relative positions through the year. It is possible that the seasonal change in the relative rate of water loss from the top foot is related to variations in evaporation from the soil surface and to changes in root activity caused by seasonal changes in soil temperature. From the curves representing use of water from the different foot depths it is apparent that the use of water from the lower depths was relatively less than from the upper levels in winter and spring. This indicates that soil temperatures did not have a dominant influence on water absorption by the roots.

The average monthly use of water from the top 7 feet of soil is shown by the bar graphs in Figure 2. The highest monthly use, 7.5 inches, occurred in July and the lowest, 2.1 inches, in February. The amount of water used during the months of June, July and August was nearly three times that used in the months of December, January and February. The average yearly use of water from the top 7 feet of soil was 51.1 inches.

Some roots almost certainly extended below the zone sampled for roots; in fact, there was only a slight decrease in root concentration from 10 to 20 feet. Therefore, it was estimated that only about 80 percent of the feeder roots occurred in the top 7 feet of soil from which soil samples for moisture determinations were taken. It has been shown that extraction of water is roughly proportional to root concentration (2). Therefore, 51.1 inches probably represents about 80 percent of the total consumptive use, and the total yearly use of water from the entire root zone must have been about 5 feet. With 75 percent efficiency in application of water, the yearly water requirement, or amount of water that would have to be applied to provide the trees with the approximately 5 feet of water needed for transpiration, would be about 7 feet. Pillsbury (6), in his investigation of the use of water by dates, principally the variety Deglet Noor, found that the average yearly transpirational use was about 6 feet and that the water requirement was about 7.5 feet. Considering the small size of Khadrawy palms as compared with Deglet Noor, the results of the present investigation seems to be in good agreement with Pillsbury's findings.

The average yearly application of water to the plots used in this study was 8.5 to 9 feet. More than the amount required for transpiration and evaporation from the soil was applied to insure against the accumulation of salts in the root zone. With the use of Colorado River water, which contains about a ton of salt per acre-foot

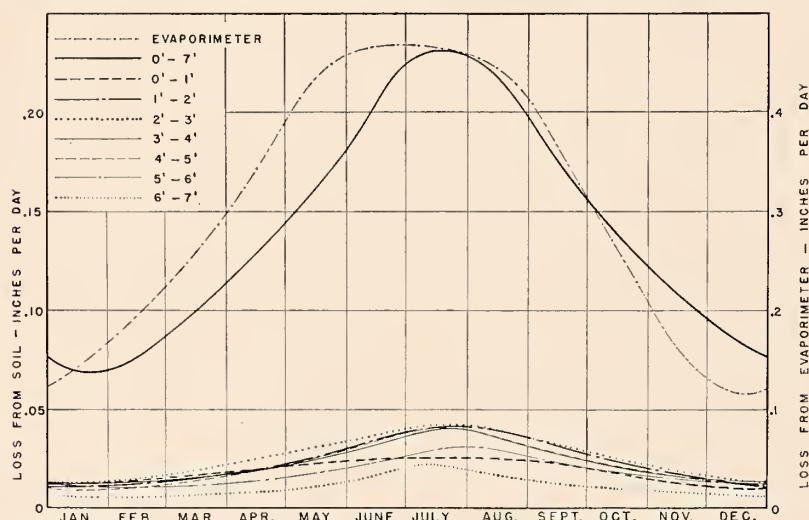


Figure 1.—The average rate of evaporation from a shallow black-pan evaporimeter and the average rates of water loss (consumptive use) from the top 7 feet of soil and from each foot depth of soil sampled in a Khadrawy date garden in relation to season.

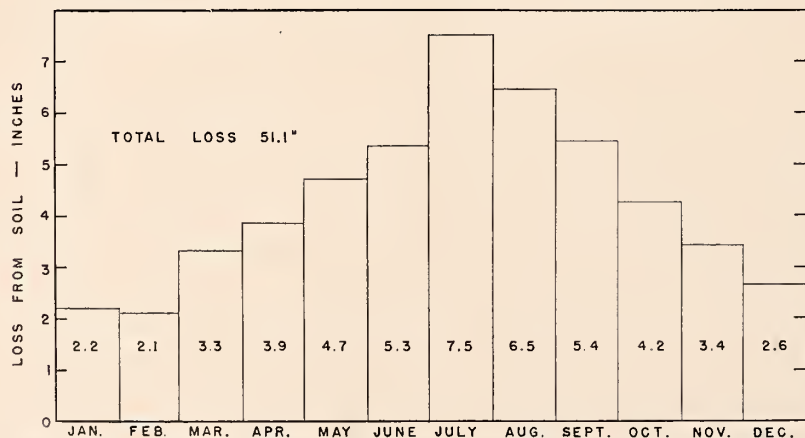


Figure 2.—The average monthly loss of water (consumptive use) from the upper 7 feet of soil in a planting of mature Khadrawy dates. The average total yearly loss is listed.

of water, it is advisable to do some leaching each year, since it has been estimated that with water of this salt content, if no leaching is done, only 4 acre-feet of water is required to make 1 foot of soil sufficiently saline to affect salt-sensitive plants (4). On soils no more permeable than the soil used in the present investigation the most convenient time to apply extra water for leaching is in winter when transpiration rates are low. In mid-summer the high rate at which water is extracted from the soil may make it difficult to leach salts from the root zone if there are silt and clay layers amounting to a total thickness of more than 5 or 6 feet.

From these results and those of Pillsbury, it would seem advisable in using Colorado River water on mature dates to apply a minimum of 8 feet, and preferably 9 or 10 feet per year. With 75 to 80 percent efficiency of application probably not more than 10 feet of water will be needed to supply date palms in the Coachella Valley with adequate water and to leach excess salts below the principal root zone. In very sandy soils, however, the efficiency of application of water may be extremely low, and in such situations knowledge of the amount of water transpired by the tree may be of little help in estimating the water requirements. In such soils the grower's only recourse is to apply water with such frequency and in such amounts as to keep the soil in nearly all of the root zone above the wilting point. In these extremely porous soils leaching is usually excessive, and salt accumulation is not a problem.

SUMMARY

The consumptive use of water from the upper 7 feet of soil in an 18-year-old block of Khadrawy dates was estimated from the results of frequent sampling of the soil for moisture during a period of 3 years.

About 85 to 88 percent of the feeder roots in the upper 20 feet of soil occurred in the upper 7 feet, the zone sampled for moisture; but there was little decrease in feeder-root concentration from 10 to 20 feet.

The rate of use of water from the top 7 feet was highest from the 2 to 5-foot zone, which was also the zone of highest available-water-holding capacity and highest root concentration, and was lowest from the 6 to 7-foot zone, which had the lowest available-water capacity and root concentration.

The seasonal curves of water loss from an evaporation pan and from the upper 7 feet of soil were similar, but there were divergencies in spring and fall that were probably related to wind, soil temperature and changes in leaf surface.

Except for the rate of water loss from the top foot of soil, there seemed to be little change in the relative rates of water loss from the other 1-foot depths in relation to changing season.

The highest monthly use of water, 7.5 inches, occurred in July; the lowest, 2.1 inches, in February. The average rate of use of water during June, July and August was nearly 3 times that during December, January and February. The average yearly use of water from the upper 7 feet of soil was 51.1 inches and the estimated yearly use from the entire root

zone was 5 feet. The yearly water requirement of the Khadrawy palms used in this study was estimated to be about 7 feet. From these results and from those of Pillsbury with the variety Deglet Noor, it seems likely that with the use of Colorado River water, applied with an efficiency of 75 percent or better, not more than 9 or 10 feet of water per year will be needed to meet the water requirement of mature date palms and to leach excess salts below the root zone.

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EFFECT OF TEMPERATURE AND MOISTURE CONTENT ON THE RATE OF DETERIORATION IN DEGLET NOOR DATES¹

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Dates deteriorate from the loss of characteristic flavor and odor and from the development of sirupy and dark color even though there may be no spoilage from the activity of yeast or other microorganisms. That the rate of deterioration is more rapid at high temperatures and with high moisture contents than at low temperatures and with low moisture contents has been known for many years. The present work was initiated to obtain more exact data than were currently available on the relative length of time that dates might be stored satisfactorily over a considerable range of temperatures and to gain some information on the effect of moisture content and packing house treatments on keeping quality.

MATERIALS AND METHODS

All the dates were of the Deglet Noor variety. They were given the various packing house treatments and were packaged in 8-ounce trays overwrapped with heat-sealed K202 film as soon as possible after harvest. All packages received the usual commercial dosage of one-half milliliter of fumold (15% ethylene oxide and 85% methyl formate) to reduce mold and fermentation to a minimum.

Samples of both treated and untreated dates were used in the tests. Series A and B had not been given any treatment for moistening or softening the flesh. The average moisture content of the dates in A was slightly higher than in B. Series C and D were hydrated by exposing the dates to live steam for about 4 hours. The average moisture content of the dates in C was 2 to 3 percent higher than that in D. Series E and F were processed by infiltrating with water at room temperature. This was done by drawing a partial vacuum and returning to atmospheric pressure while the dates were immersed in water. This treatment, carried out in a continuous process by means of patented equipment, was followed by a short exposure to live steam. The average moisture content of the dates in F was slightly higher than that in E. Because of difficulty in grading,

the moisture contents of each of the three pairs of series were not as far apart as had been planned and the range within each series was greater than desired. Most of the dates of these series had moisture contents within the following ranges: A, 24 to 27 percent; B, 22 to 26 percent; C, 22 to 26 percent; D, 21 to 23 percent; E, 24 to 27 percent; and F, 25 to 28 percent. The average moisture content of the processed dates was highest, that of the natural dates intermediate, and that of the hydrated dates lowest. The dates of series D were by nature driest in texture and lowest in moisture content.

Dates of each series were stored at 80, 60, 40, 32, 28, and 0 degrees F. The 28-degree storage was used to learn if there was any factual basis for the opinion of some date handlers that a storage temperature slightly lower than the freezing point of water gave an advantage appreciably greater than would be expected from the small decrease in temperature. The dates

1 to 5 in which 1 designated the poorest quality being measured and 5 the most desirable. A score of 3 designated an estimate of the poorest quality that would be acceptable by an average consumer without objection. Dates that were practically free from odor, and those devoid of characteristic date flavor were given a score of 3. A score of 2 denoted a slight off-flavor or off-odor from the effect of fermentation or mold, and a score of 1 denoted a very noticeable similar defect. In addition to the qualitative scoring of color, an extract of the pigment was made with 50 percent ethyl alcohol (1) and after uniform dilutions the depth of color was measured with a Klett-Summerson colorimeter using a blue filter. Color photographs were taken at each inspection.

RESULTS

Color. The approximate storage life, based on amount of darkening, when stored at temperatures from 28 to 80 degrees F. is given in table 1.

Table 1.—Length of time dates were stored at temperatures from 28 to 80 degrees F. before they darkened excessively.

Series	Moisture content	Temperature, degree F.				
		28	32	40	60	80
	Percent	Months	Months	Months	Months	Months
A	24-27	12	12	8	4	1
B	22-26	12	12	8	3	1
C	22-26	12	12	8	4	1
D	21-23	12	12	10	8	3
E	24-27	12	12	6	3	1
F	25-28	12	12	8	3	1

stored at 80 degrees were examined periodically up to a maximum storage of 6 months. Those stored at the lower temperatures were examined periodically up to 1 year.

Some dates of each series were transferred to 80 degrees from each of the lower temperatures for the last month of each storage period for comparison with others held continuously at the lower temperatures.

Measurements made at each examination included moisture, pH, flavor, odor, and color. The percentage of moisture was calculated from determination of the refractive index (2) and pH was measured with a glass electrode meter. Flavor and odor were scored on an arbitrary scale of

Dates stored at 80 degrees darkened rapidly; after 1 month most of them had darkened appreciably although all, with the possible exception of those in series E, were considered acceptable. After 2 months at this temperature, however, all dates except those with only about 22 percent moisture (series D) were too dark for good acceptability. The dates of series D remained acceptable in color for 3 months. When storage at this temperature was discontinued at the end of 6 months the dates in all the series were very dark.

Most of the dates stored at 60 degrees retained acceptable color for about 3 months. Those with low moisture contents (series D) had ac-

¹This project was supported by funds provided by the Refrigeration Research Foundation. The dates were supplied by the California Date Growers Association and Valley Date Growers, Inc.

ceptable color after as long as 8 months; consequently, at 80 and 60 degrees dates with 21 to 23 percent moisture retained acceptable color about three times as long as those with 25 to 28 percent moisture.

Most of the dates stored at 40 degrees retained acceptable color for about 8 months, or a little more than twice as long as those stored at 60 degrees. The advantage of lower moisture content was much less than at the higher temperatures.

Most of the dates stored at 32 degrees retained acceptable color for 1 year, but they were approaching the end of their storage life. Dates with more moisture than 26 or 27 percent should not be stored as long as 1 year at 32 degrees but should be placed in 0-degree storage soon after harvest.

Dates stored at 28 degrees retained acceptable color only a little better than those stored at 32 degrees. In three of six comparisons the dates stored 1 year at 28 degrees were more attractive than those stored at 32 degrees; in the remaining comparisons there was no obvious difference in appearance.

All the dates stored at 0 degrees retained their color appreciably better after 1 year in storage than those stored at any of the higher temperatures. These dates could have been stored much more than 1 year but since the experiment was discontinued the limit of storage life at this temperature was not determined.

The amount of darkening of dates held at temperatures from 0 to 60 degrees F. for 1 year is indicated in figure 1. The curve shows the color of an extract rather than of the actual surface color of the dates and may not represent the change in appearance of the intact dates. The retardation of darkening per degree of lowering of the temperature was greatest down to 32 degrees.

Dates that had been stored at reduced temperatures darkened at an increased rate after they were transferred to 80 degrees F. Darkening occurred at a higher rate in dates previously stored at low than higher temperatures, but after 1 month at 80 degrees the final color was still somewhat lighter in the dates with a history of low storage temperature than in those with the main storage at higher temperatures. However, by that time much of the advantage of storage at low temperature had been lost. The relative amount of darkening of dates stored at 60, 40, 32, 28, and 0 degrees for 11 months and then at 80 degrees for 1 month, in comparison with those held at the lower temperatures for the full year, is shown in figure 1.

darkening differed at high and low temperatures. Hydrated dates with moderately high moisture (series C) darkened much more in a given period at 60 degrees F. than similarly treated dates with low moisture (series D). At 40 degrees this difference was less marked, and at the lower temperatures the differences became even less noticeable.

Flavor. Retention of flavor paralleled rather closely the retention of light color. A flavor score of 4 or better was maintained as given in table 2. At the higher temperatures there was considerable variability in the length of time the flavor was retained in the different series of samples. Dates stored at 0 degrees had excellent flavor at the termination of the experiment after 1 year. In gen-

Table 2.—Length of time dates were stored at temperatures from 28 to 80 degrees F. before their flavor score was lower than 4.¹

Series	Moisture content	Temperature, degrees F.				
		28	32	40	60	80
	Percent	Months	Months	Months	Months	Months
A	24-27	12	12	6	8	2
B	22-26	12	12	12	8	2
C	22-26	12	12	10	3	1
D	21-23	12	6	4	3	1
E	24-27	12	12	6	3	2
F	25-28	12	12	8	3	2

1. Flavor was scored on a scale in which 5 represented excellent characteristic date flavor; 3 represented an absence of characteristic flavor but no objectionable off-flavor; 1 represented a pronounced off-flavor.

Deterioration proceeded even at 0 degrees F. but at a reduced rate. Dates transferred from 0 degrees to 80 degrees after different periods up to 11 months darkened more rapidly as the period of 0-degree storage increased. However, there was no suggestion of injury from the exposure to 0 degrees.

The effect of moisture content on

eral, however, a score of 4 was maintained as long as or slightly longer than the minimum acceptable color rating as given in table 1. The relatively low flavor score of the dates in series D was the result of the lower initial quality rather than of more rapid deterioration. In the Deglet Noor variety, color should be a reasonably good guide for determining acceptability if the dates are clean, of good texture, and free from fermentation and mold.

Odor. The faint pleasant characteristic aroma of Deglet Noor dates persisted for only a short time in storage. Hydrated and processed dates had lost this odor prior to the beginning of the experiment. The natural dates retained some of the aroma up to 2 weeks at 80 degrees and 2 months at 32 degrees. Temperatures down to 0 degrees were not as effective in preserving the aroma as they were in preserving other qualities, including color and flavor.

pH. The significance of changes in pH in stored dates is not well understood, but dates with high pH values (low acidity) are almost certain to have high quality. Marked lowering of pH occurred in dates stored at the higher temperatures. Typical values

Figure 1 — EFFECT OF STORAGE TEMPERATURE ON DARKENING OF DATES

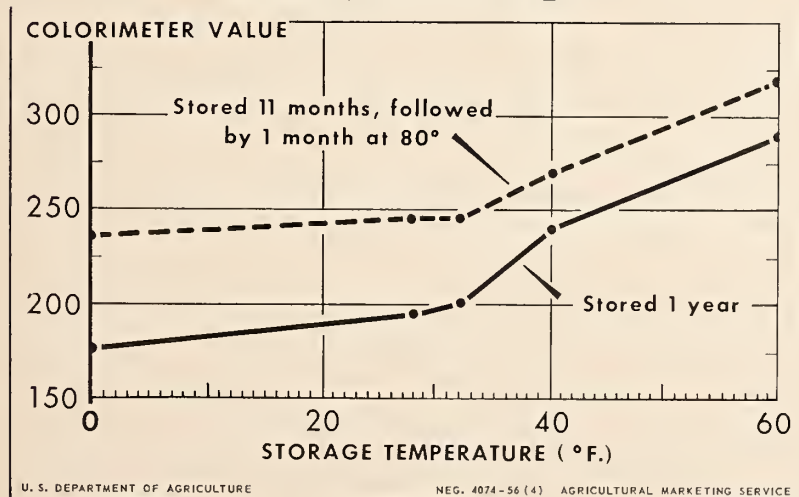


Figure 2 — CHANGES IN pH OF DATES IN STORAGE AT 0° TO 80° F.

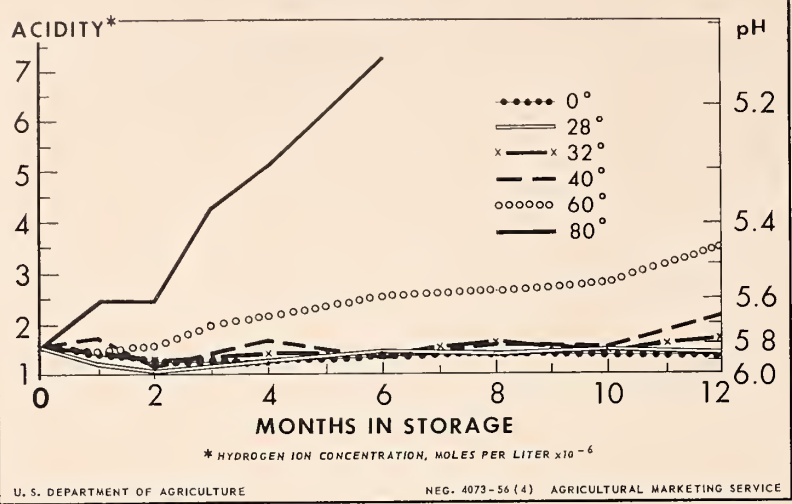


Figure 3 — EFFECT OF STORAGE TEMPERATURE ON THE pH OF DATES

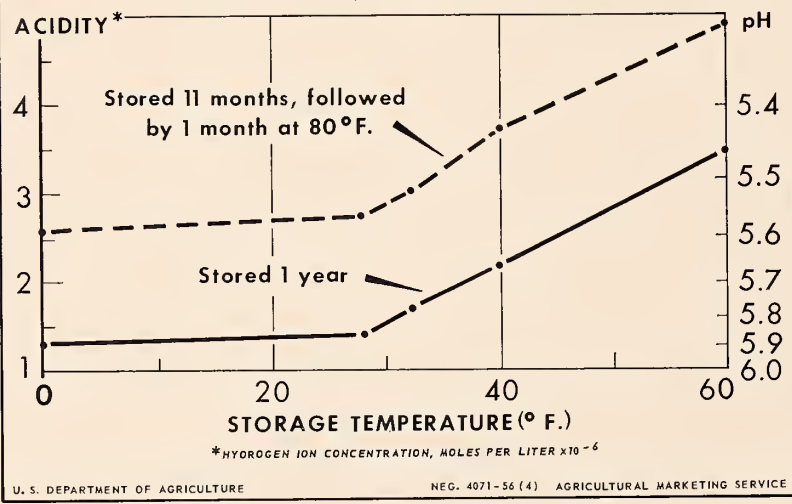
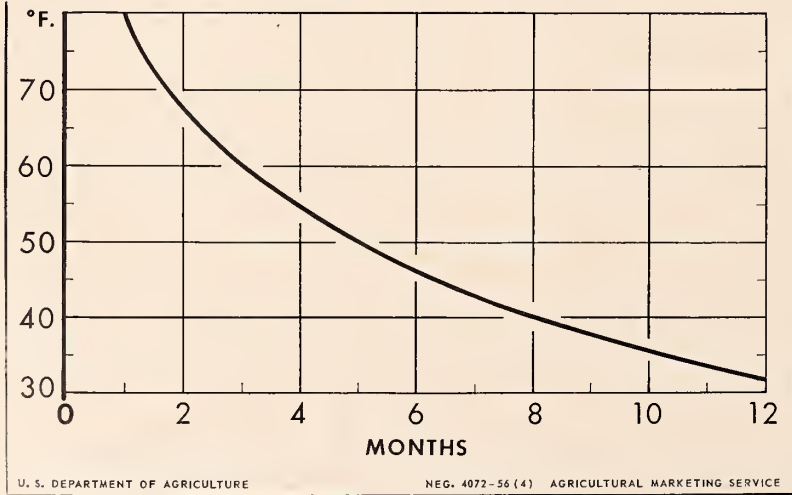


Figure 4 — APPROXIMATE STORAGE LIFE OF DATES STORED AT 32° TO 80° F.



are presented in figure 2. At 80 degrees F. the pH value fell rapidly during the 6-month storage period. At 60 degrees there was a small initial rise for about a month and then a continuous drop during the remainder of the year. At the 4 lower temperatures the pH values rose for about 2 months and then fell slowly or remained about constant as in the dates stored at 0 degrees. After 1 year's storage, the pH values were in the reverse order of the storage temperatures, with the highest values in dates stored at 0 degrees. Dates stored at 80 degrees for 6 months had far lower pH values than any of the others after 1 year's storage. The eating quality had been retained in the same order as the final pH values, but it would have been difficult to evaluate differences between dates stored at 28 and 32 degrees in some of the comparisons. The acidity as expressed by pH increased at about the same rate in all lots after they were transferred to 80 degrees from lower temperatures. Results after 1 year are shown in figure 3. Similar results were obtained after other storage intervals.

General appearance. The more moist dates, especially those in series E and F, became sirupy, first those stored at the higher temperatures, and, by 8 months also those stored at temperatures down to 40 degrees F. In the very moist dates the surfaces in contact with other dates or with the package itself acquired a light color. When these dates were separated the mottling of light and dark color made them unattractive. These light-colored areas were noticeable after 1 to 2 months at 80 degrees, 2 to 3 months at 60 and 40 degrees, 4 months at 32 degrees, and 6 months at 28 degrees. Dates with high moisture contents were affected more than the drier ones.

Effect of packing house treatment on storability. A comparison of the natural, hydrated, and processed dates showed little difference in storability that can be attributed specifically to the treatments. Most of the noticeable differences were associated with differences in moisture content. Hydrated dates of series C were usually slightly lighter than natural ones in series B, although the average moisture contents of the dates in these series were approximately the same.

Storage life in relation to temperature. The influence of temperature on the storage life of dates, as indicated by changes in color and flavor, is shown in figure 4. The moisture content of these dates was about 24 to 27 percent. The storage life extends from 1 month at 80 degrees to 1 year at 32 degrees.

Drier dates may be expected to have somewhat longer storage life,

especially at the higher temperatures, and more moist dates shorter storage life. The storage life is obviously dependent upon the condition of the dates at the time they are placed in storage as well as the temperature. The periods shown in figure 4 do not allow for an additional period at room temperature. The rate of deterioration at room temperature is such that dates in good condition when removed from cold storage should not be held at the higher temperature more than 2 weeks.

SUMMARY

Deglet Noor dates were stored at temperatures from 0 to 60 degrees

for periods up to 1 year and at 80 degrees up to 6 months. "Natural," hydrated, and processed dates over a moderate range of moisture contents were used. Changes in color, pH, flavor, odor, and general appearance were recorded.

Deterioration, as indicated by darkening, loss of flavor, and lowering of pH (increase in acidity), was more rapid at high temperatures and high moisture contents and slower as these two factors were lowered. The results suggest a maximum storage period of 1 month at 80 degrees, 3 months at 60 degrees, 8 months at 40 degrees,

and 1 year at 32 or 28 degrees. Dates may be stored considerably longer than 1 year at 0 degrees but how much longer was not determined.

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THE DATE MARKETING ORDER

By Billy J. Peightal, Manager

Date Administrative Committee

My purpose here today is to outline the objectives of a marketing order, to explain the principal and operation of your Date Marketing Order, and to mention some of the things which have been accomplished under it.

First, marketing orders are designed to assist growers in aiding themselves, with the cooperation of the U. S. Department of Agriculture, to market their production in an orderly manner. The objective of orderly marketing, as declared in the Agricultural Marketing Agreement Act of 1937 under which orders are established, is to bring "prices to farmers at a level that will give agricultural commodities a purchasing power with respect to articles that farmers buy, equivalent to the purchasing power of agricultural commodities in the base period" or, in other words, to reach the level of parity. In reality this simply means that a marketing order is designed to bring grower's returns—from dates, in this particular instance—up to the level of returns he might expect if his productive resources were used in other lines of agricultural production.

Now, a marketing order simply provides a broad framework designed to accomplish orderly marketing. Within this framework are various administrative rules and regulations under which handlers operate with respect to its requirements. The terms and provisions of an order are developed by the industry in consultation with representatives of the U. S. Department of Agriculture. These represent the industry's views of the methods by which orderly marketing best may be achieved. Before the order can become effective, a hearing is held, a recommended decision is filed, and a referendum is conducted which requires approval of at least two-thirds of the producers voting.

In addition, one-half of the handlers by volume must sign the agreement. After it becomes effective, the Secretary of Agriculture appoints a committee, representative of the industry and nominated by growers and handlers, to administer the order under his supervision.

The Committee administering the Date Marketing Order consists of seven members each of whom have an alternate. These members represent all sections of the industry and their thinking, decisions and recommendations by the nature of their representation are directed toward its benefit. The membership consists of two members who are growers but who do not belong to a cooperative, one member is a grower who is associated with a cooperative, one member is a grower who also handles his own dates, one member is a representative of cooperative handlers, and two members are representatives of handlers. It is the Committee which recommends the rules, with the approval of the Secretary, under which handlers operate with respect to the requirements of the Order, which develops the marketing policy, and which recommends appropriate quality and volume regulations to the Secretary for his consideration.

The Date Marketing Order itself is based on two premises both of which historically have proven true: (1) that consumers must be presented dates which are of good quality in order to stimulate their interest in purchasing additional quantities of dates, and (2) that under prevailing conditions the entire production of dates is not marketed in the whole or pitted form at prices which will result in satisfactory grower returns. With these premises as a basis, the Order provides for the establishment

of a minimum grade below which no whole or pitted dates may be marketed and for the establishment of volume control wherein the quantity of dates sold in the whole or pitted form is limited to the amount the trade will acquire at reasonable prices. The volume control feature, however, in no way is designed to eliminate any part of the production but simply to utilize the crop in the most effective manner among various outlets.

There should be no question about the desirability of establishing minimum grade regulations which are consistent with consumer satisfaction. There is ample evidence readily available of consumer reaction to poor quality merchandise — not only in dates but in other commodities as well. This industry particularly needs to achieve consumer confidence in California dates such as to gain and build repeat buying, for once Mrs. Housewife purchases dates of low quality she will not readily be tempted to buy California dates again regardless of price. In addition, the appearance of low quality dates in the market place affects not only the price of those dates but lowers the entire demand structure for all dates. Like most of the problems, the quality problem is not just one individual's problem but it is an industry problem—one which may be solved under the Order.

The other aspect of the Order designed to promote orderly marketing is the volume control feature. The basis for volume regulation is simply that growers will obtain greater returns if the quantity of marketable dates available for sale in the whole or pitted form approximates the trade demand with the balance utilized in other outlets. This basis in fact is

not unique with the date industry. For example, about 40 percent of the marketable Valencia oranges and also lemons are utilized in other than fresh outlets; until recently between 20 to 25 percent of the marketable walnuts were sold in other than inshell form; about 25 to 30 percent of the prune production is marketed as juice; about 30 percent of the apple production is utilized in some processed form. These are but a few examples and they are cited simply to illustrate that other agricultural industries have found that greater returns can be obtained if some of the marketable portion of the crop is utilized in other than the fresh market.

The means by which the quantity of marketable dates available for sale in the whole or pitted form is adjusted to the trade demand is through the recommendation by the Committee and the establishment by the Secretary of Agriculture of the free and restricted percentages. The Order requires the Committee each year prior to the beginning of the season to estimate the crop production, to determine the quantity of marketable dates available for sale including carryover, and to estimate anticipated trade demand. Relating the availability of dates to the estimate of trade demand automatically determines the level of the free and restricted percentages—the free portion of the crop becomes available for sale in whole or pitted outlets while the restricted portion must be utilized in other forms.

Now, let us review the accomplishments which the Date Marketing Order in its first year of operation has enabled the industry to achieve.

First, it has established the means by which in time the orderly marketing of dates will be attained. It has done this in two ways:

1. By providing a grade regulation which will create consumer confidence in California dates as a good, clean quality food. This confidence will in time reflect itself in a greater demand for the product, and will finally result in more money in the grower's pocket.
2. Through volume regulation, the excessive carryovers will be eliminated thereby preventing dumping with its disastrous effects on grower returns. An excessive carryover, as you all know, adversely affects returns in the year they occur and also the returns of the second and, perhaps, the third year.

Through Committee effort, a diversion payment program to aid in the development of new uses for dates was secured from the United States Department of Agriculture under which 3 cents a pound is paid for Grade C or better dates converted into products not previously estab-

lished on a commercial basis. It now appears that between 8 and 9 million pounds of dates will be diverted and will qualify for payment under the program which is more than double the quantity required to be set aside as restricted dates. This means that the Committee's effort will result in growers receiving between 240,000 and 270,000 dollars in addition to the amounts derived from the sale of the products for dates which otherwise would have been dumped on the market. If they had been dumped, I am convinced that grower returns this year and next would be well below growing costs.

With the Order, the market for dates actually has been and further will be expanded by:

1. Providing a consistent supply of dates sufficiently large to interest large food processing firms in using date products. These large firms otherwise would not be interested in date products and the previous products outlets would have continued to absorb only about 3 million pounds.
2. The export market can be expected to expand as a result of the Committee's efforts in securing information on which to base a request for an export subsidy program. Should the request be favorably considered, and I see no reason why it will not, the market for dates further will be enlarged. The expansion of the export and products market simply means greater grower returns.

The industry now, under the Order, is better informed with respect to the amount of current production, the sales of marketable dates, the disposition of other than marketable dates, and the size of carryover for information of this nature is given to all handlers each month by the Committee. Handlers adequately informed of the current status of the industry with respect to the availability and disposition of the crop should be able better to plan operations and their marketing program.

In the field of research, the Committee has accomplished the following:

1. It has contracted for a project with the Western Utilization Research Laboratory to investigate the causes of quality deterioration and darkening of dates with the aim of extending their shelf life.
2. The research personnel of the Department's experiment station in Beltsville, Maryland, at the request of the Committee, is exploring an electronic device designed to sort dates according to moisture content.
3. It has engaged in a consumer education program wherein recipes have been distributed to food edi-

tors, home economists and retail food trades people in an effort to stimulate further consumption of California dates.

4. Through the cooperation of Mr. Nixon, the Committee has been able to obtain a summary of research which has been done in the field of date production so that it intelligently can make requests for additional research. As a result of this cooperation, a bulletin by Mr. Nixon entitled "Date Investigations at the U. S. Date Field Station" shortly may be obtained by those who are interested in receiving it.
5. In addition to the projects previously mentioned, the Committee has requested the Department to initiate research projects, all of which have received a high priority in the Department's research program, along the following lines:
 - a. To determine the homemakers' uses, attitudes, and opinions toward domestic and imported dates and date products;
 - b. To determine the effect of selected merchandising practices on the sales of dates and date products;
 - c. To determine the nutritive value of domestic dates and date products;
 - d. To initiate efficiency studies of date packing and handling operations;
 - e. To develop methods of measurement applicable to the evaluation of market quality; and
 - f. To investigate and develop new and improved handling practices.

The high priority received for the projects far exceeds what normally could be expected considering the short time in which efforts have been extended in this direction, and it means results from this research will be available earlier than anyone originally had anticipated.

All of these accomplishments have been achieved by the Committee at a minimum of expense, for it has operated well within its established budget. Including the contract for research, it appears that the actual cost will approximate one and one-tenth of a mill per pound. This means that an amount in excess of 20 percent of each handler's current assessment will be returned next season.

I have attempted to outline here the operation of the Order, what it is designed to do and what some of the resulting benefits may be. For it to function properly and to fully accomplish its objectives, the unselfish cooperation of every grower and handler is needed. The Order is ambitious in its objectives and it will take time for these fully to be achieved.

A STUDY OF THE RELATIONSHIP OF HEAT UNITS TO THE RIPENING TIME OF DATES

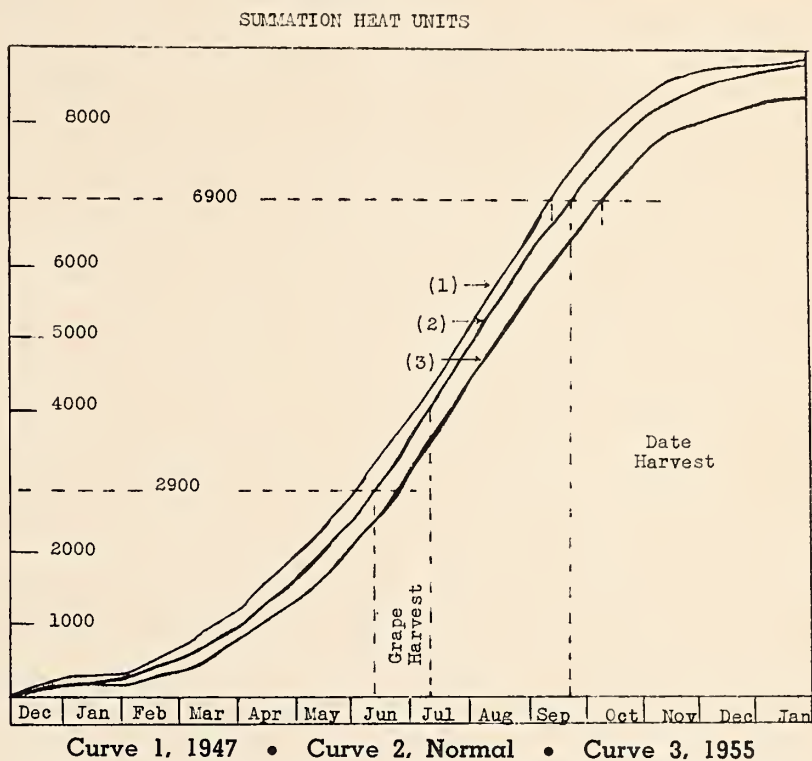
Robert E. Cook
California Date Growers Association

Increased production of dates in recent years has brought many problems. In looking for ways and means of making a packing house run smoother, it appeared that a more accurate method of forecasting time of ripening would be of benefit. About 4 years ago the writer undertook an investigation of factors affecting the ripening time. It was felt that this information could be used to time delivery of packing materials and supplies, in planning when to hire new help, in preparing a budget and arranging for financing, and in determining when, and how much, sales promotional work should be done.

Other agricultural industries have been making good use of crop forecasting for a number of years. Work has been done at University of California at Davis on apricots, prunes and other fruits, resulting in fairly accurate forecasting several weeks in advance. The principal factor involved is the amount of heat energy available to the plant or tree for growth and for the production of sugar. This energy is directly related to time and temperature. The term "summation of heat units" being a means of expressing this energy mathematically.

In connection with dates, particularly of the Deglet Noor variety, it is not news that tremendous amounts of heat are required to ripen them. To determine just how much, records of daily temperatures at the U. S. Date Gardens and records of pounds of Deglet Noor dates received at California Date Growers Association packing plant over a 20 year period have been studied. Several methods are used in figuring heat units, trial and error being the only means of telling which method works best for a particular crop.

A heat unit can be based on daily maximum temperature, daily minimum temperature, daily mean temperature, or on the area under the curved line recorded by a thermograph. The method we have used in this study is to take the daily mean and subtract 50. This gives the number of heat units for that particular day. The summation of heat units is obtained by adding the heat units day by day. Negative values, when daily mean temperature falls below 50, are not included. Fifty degrees is used as a zero point because the date palm has been found to cease growing below that temperature. Dr. W. T. Swingle (1) states that flowering and fruiting growth ceases at 64.4° F. A 64.4° maximum is fairly close



to a daily mean of 50°, so there is no major conflict here.

The chart given shows 3 curves, all based on the accumulation of heat units above a 50° zero point, using daily mean temperatures. Curve (1) is for one of the hottest years, 1947. Curve (2) is for the 50 year normal or average daily mean temperatures. Curve (3) is for 1955 which is a relatively cool year.

In drawing these curves, the problem of starting point has proved a little difficult. For other fruit crops, time of bloom is used, but for dates, it is not easy to pick just which day to use. Also no records of bloom time of previous years were available. Therefore, an assumption was made that temperatures starting back during the winter months before the blooms emerge should be counted. It has been shown by Dr. Hilgeman (2) that these buds are growing as early as November. As a starting point, December 1 was used. Using this method, the total heat units accumulated to the time of picking was always close to 6,900 units, indicated on the chart by a horizontal dotted line.

A second development of this study was in forecasting the approximate week in which any given portion of the crop could be expected to be picked by means of continuing the

heat unit curves through the harvest season. This depends on averages over a number of years as to what can be expected in (a) an early year, (b) an average year, (c) a late year. Other factors such as rain or extreme hot or cold weather can throw off the predictions.

It is of interest to note on the chart, that a line is shown for the start of the grape harvest. This line is at 2900 heat units, and seemingly, this chart works as well for grapes as for dates. In most years, from the beginning of grape harvest to the beginning of date harvest, 4000 to 4050 heat units are involved.

In conclusion, it might be well to note that this study is based on data from only one location in regards to temperature, but that time of ripening is based on a composite of many date gardens. Much more data over a period of years and from several locations would be required for scientific accuracy.

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HOW MANY FRUITS PER STRAND SHOULD BE LEFT IN THINNING THE MEDJOOL DATE?

By Roy W. Nixon

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At the 1950 Date Growers' Institute I reported fruit thinning experiments with the Medjool variety in which 10, 20, and 35 (no thinning) fruits per strand were compared (1). The results with 20 fruits per strand were superior to those with either of the other treatments. Growers of Medjool dates, however, continue to favor a smaller number of fruits per strand than 20. So an experiment in which the range of thinning was narrowed to 12, 16, and 20 fruits per strand was planned at the U. S. Date Field Station in 1955. The number of strands per bunch was also reduced: in 1950 half of the strands per bunch were removed, leaving an average of 45, and in 1955 all the inner strands were removed, leaving only the outer circle, an average of about 30. In this experiment all bunches on a single palm were given the same treatment. There were 6 palms in each treatment except that one palm selected for 20 fruits per strand could not be used for lack of sufficient bunches. The palms were 12 years of age in 1955 and not quite in full production.

Fruit was thinned the first week in June. The number of fruits per strand just prior to harvest was estimated from counts on 4 typical strands on each bunch the first week in September. Fruit was harvested in three pickings, Sept. 27, Oct. 10, and Oct. 28. The last picking was relatively small and represented fruit mostly from late bunches. Prior to each of the first two pickings samples of 100 ripe fruits were taken from two representative bunches on each palm; this fruit was picked at random except for avoiding fruit damaged by bird pecks and other obvious culls. The samples were weighed and the fruit was separated into two grades.

RESULTS

The results are summarized in Table 1. Drop over a period of 3

months reduced the number of fruits per strand from 20, 16, and 12 to 16.6, 14.0, and 10.4 respectively. The higher percentage drop in case of 20 fruits per strand is believed to be due to the fact that individual strands on which counts were made September 1 were not checked immediately after thinning when it was apparent that some strands did not have as many as 20 fruits. On the other hand, there were very few strands that lacked enough fruits to provide the maximum number set for the other treatments.

The average number of bunches per palm was less than 12, seemingly because the palms were not quite in full production. About one fruitstalk per palm was broken and the bunch was removed at the time of tying down before thinning. A number of other fruitstalks (23 on 17 palms) were partially broken in handling, but the bunches were left on the palm; most of the fruit ripened but its size was usually somewhat reduced. Such bunches, of course, were not used for samples, but their fruit was included in the total yield. The magnitude of the fruitstalk breakage calls attention to one of the difficulties in handling the Medjool variety. Its large, stiff fruitstalks break very easily at the base if much pressure is exerted in attempting to bend them.

Yield per bunch is believed to be a better basis for comparison of the different thinning treatments in this experiment than yield per palm because differences in number of bunches is accidental. Palms in maximum production under favorable conditions could be expected to produce and carry satisfactorily an average of 2 or 3 more bunches per palm than were on these young trees. The reduction in yield per bunch by thinning to 16 fruits per strand instead of 20 was almost 10% whereas the increase in fresh weight per fruit was

only about 5%. By thinning to 12 fruits per strand instead of 16 there was a reduction of more than 10% in yield whereas the increase in fresh weight per fruit was only about 3%. The differences in weight per fruit between treatments were not large, but it should be borne in mind that the initial reduction in fruits per bunch by removing the center strands of all bunches was $\frac{2}{3}$ to $\frac{3}{4}$ of the total number carried, so that an additional reduction of 10 fruits per strand would not represent more than about 10% of the total number of fruits carried by the bunch before it was thinned. The proportion of field culls (around 10%) may seem rather high, but about half of these were immature dates which dropped in picking and could not be sent to the packing house but which ripened satisfactorily after being held for several days.

Because of the slight differences in size no attempt was made to consider this factor in grading, which was done on the basis of appearance, shrivel, checking, skin separation, and other blemishes. There were no appreciable differences in grade between treatments for the first picking, representing a little less than half the crop. The second grading, however, showed some difference in favor of 16 per strand. Thinning to 12 fruits per strand increased the amount of shrivel and lowered the grade.

CONCLUSIONS

On the basis of this experiment there is some doubt as to whether thinning to 16 fruits per strand would bring higher returns than thinning to 20 fruits per strand. The differences in grade and in weight per fruit were slight, but were both in favor of 16; with a large price differential in grade the returns might be sufficient to offset the reduction in yield. However, with only 12 fruits per strand the definite trend to lower grade suggests that returns from this treatment could not possibly equal those from 16 fruits per strand. In considering the number of fruits per strand at time of thinning one should bear in mind that there will usually be a drop of at least 15 to 20 percent by the time of harvest.

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Table 1.—Effect of Different Fruit Thinning Treatments on Medjool Dates.

	Number of fruits per strand, June 1		
	20	16	12
Average number of fruits per strand, Sept. 1.....	16.6	14.0	10.4
Average number of strands per bunch.....	30.5	30.3	29.0
Average number of fruits per bunch, Sept. 1 (calculated).....	506.3	424.2	301.6
Average number of bunches per palm.....	11.6	9.5	9.7
Average yield per palm (pounds).....	214.4	158.5	138.0
Percentage of field culls	12.2	12.2	9.4
Yield per bunch exclusive of field culls—calculated (lbs.).....	16.2	14.7	12.9
Average number of fruits per pound as picked.....	18.9	18.0	17.3
Percentage of crop in first picking.....	44.6	40.3	48.2
Percentage of Grade A fruit in first picking.....	69.3	71.5	71.0
Percentage of Grade A fruit in second picking.....	31.7	37.8	33.0

ACCIDENT PREVENTION IN THE DATE INDUSTRY

W. G. Kennedy, Safety Engineer

California State Compensation Insurance Fund

The problems of prevention of industrial accidents and possibility of serious injuries to workers in date production literally grow with the palms, not year by year, but in three periods or stages.

While the palms are young and can be worked from the ground, the principal hazards are thorns, the use of knives and axes, slips and falls, handling the harvested dates, application of insecticides and transportation of employees.

The next period, during which work is performed while standing on ladders, includes all of the above hazards and the added possibility of falling from, being struck by and strains from handling ladders. As the height increases, so does the potential seriousness of the injury from these added hazards.

The third stage, when it is no longer practical to work from ladders, has been the source of greatest trouble. It includes all the hazards of the first two stages and the much greater possibility of falling while reaching the working area and while doing the work.

The increasing height of the palms in the two latter stages also adds the possibility of electrical shock from power lines. This may come from direct contact or by handling metal ladders and tubes used for dusting.

Analysis of reports of sixty-three date garden accidents, with injuries requiring medical treatment, reported from June 1 to early November, 1955, is shown in the accompanying chart. The alarming part of this picture is that 20% of the total were falls from palms, any one of which could have meant death to the worker.

Injuries included fractured vertebrae in six cases, with fractured shoulder and fractured heel added in two of them. Others were two fractured arms, one fractured foot and two severe back injuries, with accompanying concussion and shock. The picking season, requiring much time in the palms, was hardly started during the period.

There is a general belief that the majority of accidents result from carelessness, which may be true, but there is a definite cause for carelessness and we must find and try to eliminate it.

Eight of the reports on falls indicated carelessness in changing position with the saddle. Some things which could have caused this include

lack of knowledge, improper instruction, failure to follow instructions, inattention to work, mental attitude, physical condition and distraction.

One worker fell when he lost his balance while lowering a full bucket of dates to the ground.

Another fell when the saddle broke. He reported that "the saddles were old."

Another said that the snap, which attaches the chain to the saddle, opened. This could have been faulty equipment or carelessness.

These severe injuries could have been prevented by safety chains properly used. Close supervision, including insistence on use of safety equipment, is the only hope for control.

The man who fell from the ladder no doubt made a mistake which he may have made before with no harmful results. Close supervision could have detected the fault and prevented the accident.

The degree to which carelessness is involved in the thorn injuries is negligible. A good job of de-thorning would remove much of the hazard during the time covered by the accident chart, and the recently developed hand shields for knives and axes should practically eliminate thorn injuries in de-thorning work.

The chance of carelessness causing electrical injuries can be eliminated by management. Work, where such hazards cannot be removed, should be done by experienced men under close supervision.

Transportation of employees has been the source of injury and death to many agricultural workers. Every employer should know and comply with the laws on this subject, with very careful selection of drivers.

The responsibility for preventing these accidents lies directly with management.

Just a short time ago, as I drove into a date garden of palms twenty-five to thirty feet tall, I noticed a wooden ladder leaning against a palm so that it reached to within eight or ten feet of the lower fronds. Just by chance I glanced on up into the palm and there was a man perched in the fronds evidently pollenating. Climbing the frond stubs from the top of the ladder was the only way in which he could have reached his position.

When the hazard was discussed with the manager, who was on the premises, he agreed that he was at

fault, ordered the men down and said that he would bring proper ladders from "the other ranch" before the work was continued.

There is little doubt about the thoughts of that manager if one of the men had been injured or killed by falling from a palm, but how much better it would be to do the thinking and acting before an accident.

There are two principal reasons for preventing accidents and injuries, either of which is sufficient to warrant all-out effort by all concerned.

Suffering by injured may vary in degree to include serious permanent disability and may even result in death.

Cost or financial loss to both employee and employer is divided into two parts. Direct cost includes medical and compensation payments to injured, usually covered by Workmen's Compensation Insurance. Indirect cost includes time lost by injured and others, reduced earning power, cost of training a new man, damaged equipment and materials, interruption of production, money loss by injured, penalties for negligence and many other items.

Date growers in Coachella Valley have had evidence of the adverse effect of injuries on insurance costs.

The Workman's Compensation Laws provide that indemnity for a death may be \$10,000 or \$12,500 in accordance with conditions of employment and type and number of dependents, regardless of earnings. Some disability cases may cost much more.

These costs must be paid by California employers and insurance rates are based on the principle that each industry or business should pay its own costs as far as possible with the total risk spread among all employers.

It would require a minimum of forty years for a \$300 annual insurance premium to pay the indemnity alone in a \$12,000 death case.

Few date gardens would ever pay back the cost of one death case at normal average rates; so others must help.

Indirect costs can be determined only by the employer and employee, but it is estimated that they average at least four times the direct costs.

For many years need for accident prevention was recognized only as it carried along with procedures that helped in doing a faster job. Numerous methods were devised, but their

use was not industry wide. All efforts were on an individual basis with little or no exchange of ideas.

Those who provided proper equipment and insisted on its use had little trouble. Some bought the equipment, gave it to the men and hoped they would use it. Others let the troubles grow, but did nothing about it.

In recent months, under pressure of steadily increasing insurance costs and the possibility of loss of necessary employees, some cooperative effort has started.

Through the efforts of the field crew of the California Date Growers Association and others, the idea of the safety chain was developed and made available to all growers, but at least two falls were reported later in which safety chains were not used.

Reports of men being saved by the safety chains were publicized, but re-

cent surveys revealed that some growers have still not taken steps to provide them.

Like other protective equipment, the chain gives added security which, with some men, means increased efficiency and, with others, recklessness. The need for supervision and control has not been removed.

Next came the development of the hand shields for knives and axes. That they are effective is shown by the record of the California Date Growers Association. With a crew of 120 men, 39 thorn injuries were reported from December 26 to February 4, with no hand shields in use.

After all men were supplied with the protection, only 8 thorn injuries were reported from February 4 to February 20, all in legs or arms not covered by the shield.

Some growers purchased the shields

as soon as they saw them, even though their de-thorning was almost completed. Others procrastinated and continued to report thorn injuries with their suffering and loss of time.

The idea that "It Can't Happen to Me" is still with us and must be eliminated.

A new type saddle is now being designed by the same men who developed the chain and shields. First models indicate that it will be another valuable aid to efficiency and safety in date palm work. Suggestions are welcomed by these men and everyone can and should contribute.

The material presented thus far has been given in an effort to show that continuing action is necessary and that only cooperative effort and close supervision and attention by management can keep accident prevention ahead of the growth of the palms and in step with efforts toward improving the industry.

With this in mind, the State Compensation Insurance Fund, through its Safety Services, has discussed the problems and proven safe practices and equipment with each Fund insured. In addition, a meeting of those employers and their supervisors is to be held in a convenient date garden for a discussion of details of future safety activities, including actual demonstration of equipment and methods which have been found to be practical and safe. Others who may desire to participate will be more than welcome.

The program resulting from this meeting and future activities will apply to all Fund insureds. It will be for the benefit of all concerned and its effectiveness will depend on the ideas and efforts of individual supervisory personnel and employees. Assistance will be continued by Fund safety personnel.

STATE COMPENSATION INSURANCE FUND ACCIDENT AND INJURY DATA

COACHELLA VALLEY	DATE GARDEN ACCIDENTS - 1955									
	June	July	Aug.	Sept.	Oct.	Nov.				
Fall from Palm - Picking				///	///					
Bagging			//	/						
Trimming			/							
Fall from Ladder - Picking					/					
Thorns - Trimming			//	///	//				Thorns	
Cleaning up				//					Foot	
Picking				//	//				Leg	
Tying bunches		/							Finger	
Feeding shredder			//							
Bagging			///	//						
Irrigating				/						
Axe cut - Trimming	/		///	///						
Back strain			//	/						
Struck by - Falling object			//			//				
Ladder struck power line-Burn						//				
Slip & Fall - same level						/				
Miscellaneous			///	///						
Total		1	1	30	18	6	7			63

Date Growers' Institute - 1956 Membership

(As of August 15, 1956)

Arkell Date Garden Indio

Bisbee, Melvin Thermal
Blackburn, R. W. Thermal
Breyer, Alberto . . . Buenos Aires, Argentina
Brown, Thos. R. Thermal

California Date Growers Assn. Indio
Cast, Edna—Garden of Setting Sun . . Mecca
Cavanagh, H. L. Indio
Citrus Experiment Station Riverside
Coachella Ranches—D. A. Stevning, Riverside
Coachella Valley Publishing Co. . . . Indio
Codekas, Terris Thermal
Cook, Robert E. Indio
Cook, W. W. Palm Desert
Cosgrove, Robert S. Indio
Crommelin, Mrs. J. B. Palm Springs
Cruess, W. V. Berkeley

Darley, E. F. Riverside
Darnell, W. G. Brawley
Dates Officer Berbera, Somaliland
DaVall, E. K. Cathedral City
Davis, E. Fred Los Angeles
Dillman, R. S. Yuma, Arizona

Echols Ranch Thermal
El Fawal, Ahmed Naguib Damarhoor, Egypt
Embleton, Tom W. Riverside

Farrar, E. Keith Indio
Furr, J. R. Indio

Gandra, Heloisa Sao Paulo, Brasil
Geissler, Walter E. Indio

Heiny Nursery Brawley
Henderson, Randall Palm Desert
Higazy, M. A. Gawad Cairo, Egypt
Hilgeman, Robert H. Tempe, Arizona
Howie, Robert M. - Agriculture Commissioner
. Riverside

Jaleto Ranch (H. J. Norris) Los Angeles
Jarvis, Eugene Thermal
Jenkins, Paul Indio
Jenkins, W. G. Indio
Johnson, Mrs. May Yuma, Arizona

Kral, Louis Calexico

Laflin, Ben, Jr. Thermal
Laflin, Ben, Sr. Thermal
Lichty, Kenneth Indio
Lindgren, D. L. Riverside

Macpherson, D. F. Indio
Martin, Martha Reid Rancho Mirage
Mitchell, Don Indio
Mock, D. C. Redlands
Mounib, M. F. Jedda, Saudi Arabia
Mrak, Emil M. Davis

Nixon, Roy Indio
Noland, Warren Los Angeles

Patterson, Kenneth Coachella
Peightal, B. J. Indio
Pinyan, R. A. Indio
Puls, J. H. Pasadena

Reid, Robert Chicago
Reuther, Walter Riverside
Richardson, H. B. Davis
Richardson, Walter L. Porterville
Russel, Robbins Redlands
Rygg, G. L. Pomona

Schroeder, C. A. Los Angeles
Schwabacher, Albert E. San Francisco
Schields, Floyd Indio
Sunipalms Date Gardens—E. L. Christian, Indio
Swingle, Leonhardt Indio
Swingle, Mrs. Maude Washington, D. C.

Turk, Howard Coachella

Venus Foods Los Angeles
Vincent, Lloyd Riverside

Wallace, Earl Thermal
Webb, Robert W. Palm Desert
Westerfield, John Coachella
Wilson, Gwynn Los Angeles
Wise, George A. Mecca
Wolfe, A. F. New York
Woodbury, George J. Indio

Yowell, Hillman Indio

